REMARKS

This amendment is responsive to the Office Action dated January 24, 2006. Claims 1, 4, 9 and 10 are pending in this application and have been rejected. Reexamination is respectfully requested in view of the foregoing amendments in claims and the following remarks.

These remarks follow the order of the outstanding Office Action beginning at page 1 thereof.

Priority Under 35 USC § 119

Priority was not acknowledged in this Office Action, although it was acknowledged in a previous Office Action dated May 4, 2005. Correction is respectfully requested.

Continued Examination

Applicant appreciates the acknowledgement of the continuation under 35 CFR § 1.114.

Drawings

Applicant appreciates the withdrawal of objections to the drawings.

Claim Objections

In claim 4, Applicant has changed the word "the" to "a" as appropriate.

Claim Rejections - 35 USC § 112

Applicant appreciates the withdrawal of previous rejections.

Claim Rejections - 35 USC § 102(b)

Outstanding claims 1, 4, and 9 - 10 have been rejected under 35 USC § 102(b) as being anticipated by Tsuji. As stated in the Examiner's response to arguments, the Examiner contends that Tsuji's capacitor anticipates a "surge absorber." The Examiner correctly notes that Applicant now specifies that the suppressing part is a "surge absorber" and argues that the Tsuji capacitor anticipates such a surge absorber. See paragraph [08].

Applicant respectfully traverses this rejection because it is contrary to MPEP § 2111.01.

Applicant's disclosure in paragraphs [0013] and [0020] specify that the static electricity suppressing element could utilize a surge absorber or air gap. Applicant in the claims has amended prior to this Office Action, narrowed the claims to the term "surge absorber", thereby excluding air gaps (which may be a form of capacitor).

Applicant respectfully submits that the term "surge absorber" has taken on separate meaning in the art from a capacitor. A simple capacitor to which the examiner points, has

no means for dissipating energy in the capacitor because there is no resister in parallel with the capacitor or any other way to dissipate energy, see capacitor C2, Figure 8, Tsuji.

To illustrate that the term "surge absorber" has acquired separate meaning in the art, and is not merely a capacitor, Applicant includes for the Examiner's consideration the following attached materials.

First, Attachment 1 is Webster's definition of a surge absorber taken from an edition dated 1986. This definition requires dissipation of the energy of a surge. The examiner has not stated how this can occur in the capacitor.

In Attachment 2, Applicant includes a print out of a search in the Patent Office database for the term "surge absorber" as found in Abstracts. This search shows that the term "surge absorber" has acquired separate meaning in the art from mere capacitors. The undersigned has reviewed some, but not all of the references identified and found them to be devices other than capacitors. This search illustrates that the term "surge absorber" has acquired separate meaning in the art from the definition of a capacitor.

In Attachment 3, Applicant conducted a broader search in the Patent office database for the term "surge absorber." The results of this search are shown in Attachment 3. Attachment 3 also includes a partial printout of US Patent 6,731,490 that shows that the term surge absorber as used in the surge absorber

art does not refer just to a capacitor, as the examiner would contend. In order to further understand the meaning of surge absorber as it has been developed in the art, the undersigned has identified many patents that are early in time which illustrate various serge absorber constructions. A review of the patents identified by the undersigned shows that they must have some means for dissipation of energy. The Examiner does not show in the outstanding Office Action if there is any dissipation of energy taking place in the capacitor. Instead, the Examiner only argues that capacitors might absorb energy. However, and more importantly, a review of the attached patent pages and abstracts show that even by 1972 (US Patent 3,654,511), the term "surge absorber" was distinct from the term "capacitor". Attachment 4 is a collection of first pages of surge absorber patents that illustrate that surge absorbers are not merely capacitors.

A Google search was conducted on the term surge absorber. This search covers technology contemporaneous with the Applicant's filing date. As a result of this search, the undersigned identified information describing surge absorbers and how they work. The results of this search are included with Attachment 5 to this amendment and response. The devices and voltage characteristic curves of this collection show that a surge absorber does not have a voltage characteristic like that of a capacitor that is a build up of charge. The surge absorbers show voltage curves (pages 5-3, 5-4 and 5-8) where the voltage is

limited and there is an absorbed surge wave. As time extends, suppression continues. None of the devices shown and none of the curves shown in this collection would describe a capacitor standing alone as the Examiner contends with respect to the capacitor in the Tsuji reference.

Attached as Attachment 6 is a group of documents describing a DIA surge protector (DSP). This is similar to the device shown at pages 5-21 and 5-22 (which is in English). In such surge suppressors, there is little if any capacitance, and there is no polarity at all. When voltage more than a regulation voltage is built up between terminals of the surge absorber, an electric discharge will be started and a surge curve will flow. This is unrelated to frequency like that of a capacitor. On the other hand, when the impedance of a capacitor is high in a direct curve case, it has small impedance when the frequency becomes high. A capacitor is a frequency sensitive device while a surge protector is a voltage sensitive device. This is shown in the DIA materials.

The Term Surge Absorber

The term "surge absorber" has clearly developed as a separate device as is well known in the art as illustrated by the patented art, and descriptions of devices manufactured. In none of this art is a surge absorber as a capacitor. Even in the most fundamental dictionary (Attachment 1), it is required that the

surge absorber dissipate energy. The Examiner has not illustrated how the single capacitor in the reference of record is dissipating energy. However, and more fundamentally, the capacitor is a frequency sensitive device, and not voltage sensitive. Stated another way, the capacitor if it does not break down, can withstand an infinite DC voltage. A surge absorber cannot. Conversely, the serge absorber is responsive to high voltage, not high frequency.

It is, therefore, respectfully submitted that the Examiner's argument that a capacitor is a surge absorber is contrary to the common meaning of the phrase "surge absorber" as developed in dictionaries and as developed in the art. Applicant's specification uses the term "surge absorber" as noted above. It is well established under Federal Circuit law that terms in a specification are to be given their ordinary meaning.

MPEP §2111.01

MPEP §2111.01 II at page 2100-48 in describing the meaning to be attributed to claim language states as follows:

> "The ordinary and customary meaning of a claim term is the meaning that term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the application."

Applicant has shown in the attachments with this response that as early as 1972 the term "surge absorber" acquired separate meaning in the art from the term "capacitor." Applicant has

further shown through Webster's Dictionary that by the mid-1980's the term "surge absorber" clearly did not include just a capacitor as the Examiner contends. Be there any doubt, as of the filing date of this application, the current literature, both patents, and information obtained through Google and information found in manufacturer's literature clearly show that surge absorbers are not construed to be capacitors.

In Applicant's specification, Applicant specifies a surge absorber. Applicant has no express intent to impart a novel meaning to this claim term. For this reason, the terms and words are presumed to take on the dictionary and customary meanings attributable to them by those of ordinary skill in the art.

Applicant has shown by the variety of sources presented to the Examiner that the ordinary and customary meaning of the term "surge absorber" as that term is used in the electrical arts does not include a capacitor standing alone as the Examiner contends.

On the other hand, the Examiner has cited no teaching in the art, nothing from the art which would show that those of ordinary skill in the art consider surge absorbers to be stand alone capacitors as shown in the cited reference.

For the foregoing reasons, the rejection is respectfully traversed.

In view of the foregoing, it is respectfully submitted that

the application is now in condition for allowance, and early action in accordance thereof is requested. In the event there is any reason why the application cannot be allowed in this current condition, it is respectfully requested that the Examiner contact the undersigned at the number listed below to resolve any problems by Interview or Examiner's Amendment.

Respectfully submitted,

Ronald R. Snider
Reg. No. 24,962

Date: April 19, 2006

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(202) 347-2600

RRS/bam

WEBSTER'S Third 1

surface equal to the **surface tension** multiplied by the surface area.

surface-friction drag *(Aero.)*. That part of the drag represented by the components of the pressures at points on the surface of an aerofoil, resolved tangential to the surface.

surface gauge *(Eng.)*. See **scribing-block**.

surface-grinding machine *(Eng.)*. A grinding machine for finishing flat surfaces. It consists of a high-speed abrasive wheel, mounted above a reciprocating or rotating work-table on which flat work is held, often by a **magnetic chuck**.

surface hardening *(Eng.)*. **Cementation** of low-carbon steels. See **nitriding**.

surface irradiation *(Radiol.)*. Irradiation of a part of the body by applying a mould or applicator loaded with radioactive material to the surface of the body.

surface leakage *(Elec.Eng.)*. That along the surface of a nonconducting material or device. May vary widely with contamination, humidity etc. It sets a practical limit to the value of high resistors for use with electrometers, etc.

surface lifetime *(Electronics)*. The lifetime of current carriers in the surface layer of a semiconductor (where recombination occurs most readily). Cf. **volume lifetime**.

surface loading *(Aero.)*. The average force per unit area, normal to the surface, on an aerofoil under specified aerodynamic conditions.

surface measure *(For.)*. A method of measuring timber in quantity, by the area of one face, irrespective of thickness. Cf. **board measure**.

surface noise *(Acous.)*. (1) See **needle scratch**. (2) Underwater noise produced by waves on the sea surface.

surface of operation *(Build.)*. A surface which is dressed to a plane as a reference from which the rest of the work can be set out and executed.

surface oil resistance time *(Paper)*. Abbrev. *SORT*. An indication of the printing ink hold-out properties of a paper by measuring the resistance to penetration by a drop of liquid paraffin spread by a roller over a sample supported on an inclined plane, under the specified conditions of test. Results are expressed in seconds.

surface pipe *(Min.Ext.)*. See **anchor string**. Also *surface casing*.

surface plate *(Eng.)*. A rigid cast-iron plate whose surface is accurately scraped flat; used to test the flatness of other surfaces or to provide a truly plane datum surface in marking off work for machining.

surface plates *(Print.)*. A general name for litho plates which are not **deep etch** or **bimetallic**.

surface pressure *(Chem.)*. The 2-dimensional analogue of gas pressure. Defined as the difference between the surface tension of a pure liquid and that of a surface active solution, it represents the tendency of the adsorbed surfactant molecules to spread over the clean liquid surface. See **Gibb's adsorption theorem**.

surface recombination velocity *(Electronics)*. Electron-hole recombination on surface of semiconductor occurs more readily than in the interior, hence the carriers in the interior drift towards the surface with a mean speed termed the *surface recombination velocity*. It is defined as the ratio of the normal component of the impurity current to the volume charge density near the surface.

surface resistivity *(Phys.)*. That between opposite sides of a unit square inscribed on the surface. Its reciprocal is *surface conductivity*.

surface sterilization *(Phys.)*. Radiation with low-energy rays which penetrate thin surface layers only, e.g. with ultraviolet rays.

surface strength *(Paper)*. The resistance of a paper to an adhesive force acting normally to the surface.

surface tension *(Phys.)*. A property possessed by liquid surfaces whereby they appear to be covered by a thin elastic membrane in a state of tension, the surface tension being measured by the force acting normally across unit length in the surface. The phenomenon is due to unbalanced molecular cohesive forces near the surface. Units of measurement are dyne cm^{-1}, Nm^{-1}. See **capillarity, liquid-drop model, pressure in bubbles**.

surface wave *(Acous.)*. Wave on the surface of liquids or solid bodies which have dimensions large compared with the wavelength. The amplitude is maximal at the surface and decays exponentially towards the interior of the body. The displacement of the medium particles is both longitudinal and transversal.

surface wave *(Phys.)*. (1) A wave propagated along the surface of a liquid. For deep water waves (the wavelength less than the water depth), the phase velocity depends on both gravitational forces and on surface tension and also on the wavelength. For shallow water waves (the wavelength greater than the depth), the phase velocity depends only on the depth and is independent of the wavelength. See **tsunami, ripple tank**. See also **wave**. (2) A component of an electromagnetic wave radiated from a relatively low antenna, which depends on the nature of the surface. See also **ground wave**.

surface wind *(Meteor.)*. The wind at a standard height of 10 m (33 ft) above ground. Differs from the **geostrophic wind** and the **gradient wind** because of friction with the earth's surface.

surface wiring *(Elec.Eng.)*. A wiring installation in which the insulated conductors are attached to the surfaces of a building, either enclosed in conduit or secured by cleats.

surfactant *(Chem.)*. An abbreviated form of *surface active agent*, i.e. a substance which has the effect of altering the interfacial tension of water and other liquids or solids, e.g. a detergent or soap.

surfactant *(Textiles)*. A surface-active agent. A compound that reduces the surface tension of its solvent, e.g. a detergent or soap dissolved in water.

surfactant flooding *(Min.Ext.)*. Recovery enhancement process in oil wells in which surface-tension reducing compounds are forced into the surrounding strata and release oil held there.

surge *(Aero.)*. Unstable airflow condition in the compressor of a gas turbine due to a sudden increase (or decrease) in mass airflow without a compensating change in pressure ratio.

surge *(Elec.Eng.)*. A large but momentary increase in the voltage of an electric circuit.

surge absorber *(Elec.Eng.)*. A circuit device which diverts, and may partly dissipate, the energy of a surge, thus preventing possible damage to apparatus or machines connected to a transmission line. Also *surge modifier*.

surge arrester *(Elec.Eng.)*. See **lightning arrester**.

surge bin, tank *(Min.Ext.)*. Hopper (dry material) or reservoir with means of agitation (ore pulps), used to minimize irregularities in process delivery and flow.

surge-crest ammeter *(Elec.Eng.)*. An instrument for recording a surge on a transmission line by measurement of the residual magnetism in a piece of magnetic material which has been magnetized by the surge current.

surge generator *(Elec.Eng.)*. See **impulse generator**.

surge impedance *(Phys.)*. See **characteristic impedance** (1).

surge modifier *(Elec.Eng.)*. See **surge absorber**.

surge point *(Autos.)*. Of a centrifugal supercharger, the value of the mass airflow at which, during throttling of the delivery, surging occurs. See **surging** (1).

surge tank *(Eng.)*. One used to absorb irregularities in flow.

surgical spirit *(Chem.)*. Ethanol, to which is added small amounts of oil of wintergreen and castor oil; used chiefly for sterilizing the skin in surgical operations.

surging *(Autos.)*. (1) In centrifugal superchargers, an abrupt decrease or severe fluctuation of the delivery pressure as the weight of air delivered is reduced. See **surge point**. (2) In valve springs, the coincidence of some harmonic of the cam lift curve with the spring's natural frequency of vibration, leading to irregular action and failure.

surmounted *(Arch.)*. A term applied to a vault springing from points below its centre and having the form of a circular arc above its centre.

surra *(Vet.)*. A form of trypanosomiasis affecting horses, dogs, cattle, elephants, and camels, occurring in Asia and

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Searching 1976 to present...

Results of Search in 1976 to present db for:
ABST/"surge absorber": 48 patents.
Hits 1 through 48 out of 48

Jump To

Refine Search ABST/"surge absorber"

	PAT. NO.		Title
1	6,891,709	T	Surface mounting surge absorber and surface mounting cap for surge absorber
2	6,840,985	T	Surge absorber flow regulation for modular pressure swing adsorption
3	6,731,490	T	Surge absorber and production method thereof
4	6,606,230	T	Chip-type surge absorber and method for producing the same
5	6,483,686	T	Circuit for indicating abnormality of three-mode surge absorber of public electric power and a multiple-end fuse
6	6,476,618	T	Circuit for indicating abnormality of three-mode surge absorber of public electric power
7	6,366,439	T	Surge absorber without chips
8	6,353,236	T	Semiconductor surge absorber, electrical-electronic apparatus, and power module using the same
9	6,291,913	T	Automotive alternator
10	6,285,535	T	Surge absorber
11	6,067,003	T	Surge absorber without chips
12	6,053,208	T	Surge absorber assembly
13	5,885,109	T	Electrical adapters
14	5,745,330	T	Surge absorber
15	5,737,162	T	Circuit breaking device
16	5,663,864	T	Surge absorber
17	5,587,867	T	Surge absorber
18	5,559,663	T	Surge absorber
19	5,557,494	T	Drive circuit of an electromagnetic device
20	5,535,083	T	Magnetic coil assembly with surge absorber

2

21 5,506,071 **T** Sealing electrode and surge absorber using the same
22 5,444,596 **T** Surge absorber
23 5,416,662 **T** Chip-type surge absorber
24 5,386,335 **T** Surge absorber
25 5,373,414 **T** Surge absorber
26 5,276,422 **T** Surge absorber
27 5,247,273 **T** Surge absorber for protection of communication equipment connected to communication lines
28 5,206,779 **T** Noise filter with surge absorber and surge absorber attached to noise filter
29 5,204,988 **T** MOS semiconductor device having a surge protecting element
30 5,200,875 **T** Protection structure for a surge absorber
31 5,198,791 **T** Surge absorber
32 5,184,273 **T** Microgap type surge absorber
33 5,036,420 **T** Surge absorber
34 4,975,674 **T** Surge absorber
35 4,814,937 **T** Defect detector circuit for inductive load driving circuit
36 4,727,350 **T** Surge absorber
37 RE32,144 **T** Reverse osmosis method and apparatus
38 4,551,596 **T** Surge-absorberless vacuum circuit interrupter
39 4,437,027 **T** Molded submersible motor
40 4,422,122 **T** Surge absorber
41 4,317,155 **T** Surge absorber
42 4,305,428 **T** Surge absorber X WATER
43 4,288,326 **T** Rotary shaft driven reverse osmosis method and apparatus
44 4,246,621 **T** Energizing circuit for solenoid valve
45 4,187,173 **T** Reverse osmosis method and apparatus
46 4,186,776 **T** Pulsation dampener or surge absorber
47 4,015,228 **T** Surge absorber
48 3,961,225 **T** Surge absorber

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3-A

Searching 1976 to present...

Results of Search in 1976 to present db for:
"surge absorber": 239 patents.
Hits 1 through 50 out of 239

Next 50 Hits

Jump To

Refine Search "surge absorber"

	PAT. NO.		Title
1	6,989,635	T	Vehicular lamp with current limiting circuit
2	6,977,425	T	Semiconductor device having a lateral MOSFET and combined IC using the same
3	RE38,837	T	Efficient power transfer in electronic ballast
4	6,920,085	T	Downlink telemetry system
5	6,905,535	T	Gas separation with split stream centrifugal turbomachinery
6	6,903,312	T	Apparatus for temperature controlling grip heater
7	6,891,709	T	Surface mounting surge absorber and surface mounting cap for surge absorber
8	6,875,376	T	Voltage non-linear resistor, method for manufacturing the same, and varistor using the same
9	6,855,981	T	Silicon carbide power device having protective diode
10	6,853,151	T	LED retrofit lamp
11	6,840,985	T	Surge absorber flow regulation for modular pressure swing adsorption
12	6,838,850	T	Method for controlling motorized storing door mirror
13	6,820,602	T	High energy ignition method and system
14	6,798,108	T	Alternator including case with open portion for brush removal
15	6,762,562	T	Tubular housing with light emitting diodes
16	6,741,925	T	User interface for electronic controller and timing sensor
17	6,731,490	T	Surge absorber and production method thereof
18	6,721,648	T	Method and apparatus for controlling a motorcycle engine
19	6,696,202	T	Electrical appliance using lithium secondary batteries
20	6,695,483	T	Sensor and rolling bearing apparatus with sensor

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3B

21 6,680,583 **T** Sign lamp lighting transformer with protective functions
22 6,680,463 **T** Power supply control circuit and cooking device
23 6,670,597 **T** Illumination sensor with spectral sensitivity corresponding to human luminosity characteristic
24 6,657,513 **T** Nonreciprocal circuit device and communication apparatus including the same
25 6,638,662 **T** Lithium secondary battery having oxide particles embedded in particles of carbonaceous material as a negative electrode-active material
26 6,627,100 **T** Current/voltage non-linear resistor and sintered body therefor
27 6,606,230 **T** Chip-type surge absorber and method for producing the same
28 6,574,120 **T** Portable relay base
29 6,568,946 **T** Receptacle assembly with a mobile receptacle
30 6,537,469 **T** Discharge counter and a nonlinear resistance material for a discharge counter
31 6,507,269 **T** Voltage nonlinear resistor
32 6,492,895 **T** Voltage non-linear resistor, method for manufacturing the same, and varistor using the same
33 6,483,686 **T** Circuit for indicating abnormality of three-mode surge absorber of public electric power and a multiple-end fuse
34 6,476,618 **T** Circuit for indicating abnormality of three-mode surge absorber of public electric power
35 6,474,585 **T** Wire winding box with increasing usable area
36 6,473,493 **T** Communication apparatus for receiving identification information of partner station, and executing communication operation in accordance with received identification information
37 6,451,192 **T** Simplified electrophoresis apparatus
38 6,448,863 **T** Differential transmission cable and joint with specific distances
39 6,437,516 **T** Unsaturating transformer, an electronic ballast using the transformer, and a self-ballasted
40 6,437,275 **T** Vacuum circuit-breaker, vacuum bulb for use therein, and electrodes thereof
41 6,406,523 **T** Rotary pressure swing adsorption apparatus
42 6,398,853 **T** Gas separation with split stream centrifugal turbomachinery
43 6,392,390 **T** Synchronous switching apparatus for use with a multiple phase power system
44 6,380,111 **T** Amorphous optical device
45 6,366,439 **T** Surge absorber without chips
46 6,362,463 **T** High frequency heating apparatus
47 6,353,236 **T** Semiconductor surge absorber, electrical-electronic apparatus, and power module using the same
48 6,340,924 **T** Repeatedly usable high-operating-speed circuit protection device using reed members
49 6,327,129 **T** Multi-stage surge protector with switch-grade fail-short mechanism
50 6,313,589 **T** Power supply circuit for traffic signal lights utilizing LEDs

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United States Patent **RE38,837**
Ahmed **October 18, 2005**

Efficient power transfer in electronic ballast

Abstract

An electronic ballast for one or more F32T8 or F25T8 or F1718 fluorescent lamps has a new design tool for efficient transfer of power to the lamp or the lamps. The design tool is constructed from the ballast DC voltage and the commercially available lamp specifications by the manufacturers or from the American National Standards (ANSI). This design tool is shown below. ##EQU1##

- where W=Lamp rating in watts,
- V_0=Lamp voltage.
- V_1=Electronic Ballast DC voltage,
- R_0=Lamp Impedance in ohms, (ANSI C78.1-1991).
- k=Empirical constant=1.5 to 10.0.

3C

Inventors: **Ahmed; Zahir M.** (Palos Verdes, CA)
Assignee: **Power Electronics and Systems, Inc.** (Torrance, CA)
Appl. No.: **385178**
Filed: **March 10, 2003**

Related U.S. Patent Documents

	Patent No.:	Issued:	Appl. No.:	Filed:
Reissue of:	**05872431**	**Feb 16, 1999**	**08722370**	**Sep 27, 1996**

Current U.S. Class: **315/307**; 315/241R; 315/246
Intern'l Class: G05F 001/00
Field of Search: 315/283,288-289,291,307,241.R,224-226,209.R,246

References Cited [Referenced By]

P-4

g: The switching transistors Q2, Q3 of any type are supplied by a regulated boost power supply connected between terminals **14**, **15**, **16**, and **17** of output voltage V**1**.

h: The switching transistors Q2, Q3, when of the MOSFET type, are driven by the integrated circuit IR **2151**, IR **2155**, or equivalent.

i: The boost power supply (L1, C1, C2, C3 and C4) receives power from one of the following power utility lines.

j: 120 v 60 Hz, 220 v 50/60 Hz, or 277 v 50/60 Hz can be used to provide the rectified output for the boost regulator which in turn corrects the power factor using an integrated circuit to shape the current wave form to follow the voltage wave form.

k: An EMI filter is connected between terminals **8**, **9**, **10**, **11**, **12** and **13** and includes a common mode choke, L**1**.

3-D

l: A line transient protector VZ1 is connected between terminals **18** and **19**.

The black and white wires leading from the ballast are connected to a single-phase 120 v 160 Hz line through a switch (not shown), while the green wire is connected to the earth terminal (refer to schematic). The ***surge absorber,*** VZ1, clamps any unusual voltage transients exceeding 150 volts and protects the components of the ballast from damage. The clipper VZ can absorb 4500 amps without damage. Transients of this magnitude are extremely rare.

Next, the EMI filter consists of a front-end AC capacitor C1, a common mode inductor L**1**, two line-to-earth ground high frequency capacitors C2 and C3, and an AC capacitor C**4** across the AC line just before the rectifier bridge. This entire filter will reduce conducted emission on the AC lines as required by FCC regulations.

The rectifier bridge CR**1**-**4** (D1-D4), provides a rectified output to the power factor correction boost regulator. The rectifier bridge is further protected by the AC polyester capacitor C**5** which filters the switching noise from the power factor boost regulator. The boost regulator inductor L**2** switched by the transistor Q1 provides higher DC voltage than the average input voltage. The integrated circuit U1 functions as a power factor corrector as well as a voltage regulator component.

The regulator output voltage is then switched into the resonant circuit L3 and C**15** which provide sufficient sine wave peaks to ionize the lamp **1** and strike the arc. When the arc is established, the damping factor of the resonant circuit increases enough to supply the desired electrical power into the lamp, based upon the impedance of the lamp. The damping factor is a function of the capacitor C**15** selected as per the stated design method described above.

The fifteen microsecond period of the sine wave and 0.0047 microfarad capacitance across the lamps conform to the invented design tool which provide the required power to the lamp and minimize the volt amperes stunted by the capacitor C**15**.

However, if the capacitor value is increased, for example, to 0.01 microfarad and frequency is unchanged, the new capacitor value will draw twice the current, which means much higher watts from the boost regulator for the same power consumption by the lamp. Thus, the ballast would be inefficient.

The above design tool is unique because the frequency of the lamp voltage and the capacitor value across it are interdependent for efficient power transfer to the lamp. Efficiency is the prime factor in

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(17 of 239)

United States Patent	**6,731,490**
Ikeda , et al.	**May 4, 2004**

3-E

Surge absorber and production method thereof

Abstract

The invention relates to a ***surge absorber provided with; a surge absorber*** element composed of a columnar non-conductive member and a conductive film formed dividedly via a discharge gap on a peripheral surface of the non-conductive member, a pair of sealing electrodes disposed at opposite ends of the ***surge absorber*** element and touching the conductive film, and a glass tube with opposite ends closed by the sealing electrodes, and the ***surge absorber*** element and an inert gas encapsulated thereinside. In the ***surge absorber*** of the invention, a face of each sealing electrode which contacts with the ***surge absorber*** element is formed in a concave shape symmetrical with a central axis of the glass tube. As a result the surge absorber element can be positioned in the center of the glass tube with high accuracy, the life span and the surge current capacity of the surge absorber can be improved, and low cost and small size becomes possible.

Inventors: **Ikeda; Hiroyuki** (Chichibu-gun, JP); **Nakamoto; Takahiro** (Chichibu-gun, JP); **Asami; Masanobu** (Chichibu-gun, JP)

Assignee: **Mitsubishi Materials Corporation** (Tokyo, JP)

Appl. No.: **965855**

Filed: **October 1, 2001**

Foreign Application Priority Data

Oct 02, 2000[JP]	P2000-302704
Oct 30, 2000[JP]	P2000-331509

Current U.S. Class:	**361/120**; 361/128; 361/129; 361/130
Intern'l Class:	H02H 001/00
Field of Search:	361/120,121,126,128,129,130 313/325,331,335,631 337/28-34

References Cited [Referenced By]

U.S. Patent Documents

5198791	Mar., 1993	Shibayama et al.	337/31.
6366439	Apr., 2002	Yang	361/120.

Foreign Patent Documents

7-320845	Dec., 1995	JP.

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Primary Examiner: Sherry; Michael
Assistant Examiner: Laxton; Gary L.
Attorney, Agent or Firm: Oblon, Spivak, McClelland, Maier & Neustadt, P.C.

Claims

3F

What is claimed is:

1. A ***surge absorber*** provided with; a ***surge absorber*** element composed of a columnar non-conductive member and a conductive film formed dividedly via a discharge gap on a peripheral surface of said non-conductive member, a pair of sealing electrodes disposed at opposite ends of said surge absorber element and touching said conductive film, and a glass tube with opposite ends closed by said sealing electrodes, and said ***surge absorber*** element and an inert gas encapsulated thereinside,

wherein a face of each sealing electrode which contacts with said surge absorber element is formed in a concave shape symmetrical with a central axis of said glass tube.

2. A ***surge absorber*** according to claim 1, wherein a flat portion is formed on at least one portion of an outer peripheral surface of said glass tube.

3. A ***surge absorber*** according to claim 2, wherein at least a pair of said flat surfaces are formed in parallel on opposite sides of said glass tube.

4. A ***surge absorber*** according to claim 3, wherein a transverse section of said glass tube is a square shape touching an outer periphery of said pair of electrodes.

5. A ***surge absorber*** according to any one of claim 1 through claim 4, wherein a ratio of a transverse section area of said ***surge absorber*** element to a transverse section area of an inner space of said glass tube is from 1:3 to 1:15.

6. A production method for a ***surge absorber*** provided with; a ***surge absorber*** element composed of a columnar non-conductive member and a conductive film formed dividedly via a discharge gap on a peripheral surface of said non-conductive member, a pair of sealing electrodes disposed at opposite ends of said ***surge absorber*** element and touching said conductive film, and a glass tube with opposite ends closed by said sealing electrodes, and said ***surge absorber*** element and an inert gas encapsulated thereinside,

said method having;

an insertion step for inserting one of said pair of sealing electrodes, said glass tube, said ***surge absorber*** element, and the other of said pair of sealing electrodes in this order into a hole formed in a production

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jig of an internal diameter into which said glass tube can be inserted; and

a welding step involving replacing an atmosphere gas inside said hole with an inert gas and then welding said sealing electrodes to said glass tube inside said hole by heating said production jig,

and a face of each sealing electrode inserted in said insertion step which contacts with said ***surge absorber*** element is formed in a concave shape symmetrical with a central axis of said glass tube which is inserted.

Description

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BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a ***surge absorber*** used to protect various devices from surges and to avert accidents beforehand, and to a production method thereof.

2. Description of the Related Art

Surge absorbers are connected to parts that can easily receive electric shocks due to abnormal voltages (surge voltage) from lightning surges and static electricity, such as CRT driving circuits, and the communication lines and connections of electronic devices for use in telecommunication equipment such as telephones, facsimiles, and modems, in order to prevent thermal damage or ignition due to abnormal voltages, of the printed board on which the electrical devices and their equipment are mounted.

Heretofore, a ***surge absorber*** using a microgap ***surge absorber*** element, such as disclosed for example Japanese Unexamined Patent Application, First Publication No. Hei 7-320845, has been proposed. This ***surge absorber*** is one where, in an electric discharge ***surge absorber where a surge absorber*** element with a pair of cap electrodes provided on opposite ends of a ceramics member encapsulated by a conductive film and with a so-called microgap formed on a peripheral surface thereof is accommodated inside a glass tube together with an inert gas, as shown in FIG. 11, the opposite ends of a glass tube 1 are sealed by bonding a pair of sealing electrodes 2 by high temperature heating. This ***surge absorber*** is a surface mount type (melph type) ***surge absorber***. There are no lead wires in the sealing electrodes 2, and when mounting, this is connected and secured by soldering the sealing electrodes 2 to a substrate.

As illustrated in FIG. 12, this kind of ***surge absorber*** is made by inserting one sealing electrode 2, a glass tube 1, a ***surge absorber*** element 4, and then the other sealing electrode 2 in this order into a hole portion 10a formed in a carbon heater jig 10, and then after replacing the interior with an inert gas, heating the carbon heater jig 10 under a condition with a pressure applied axially, so that the opposite ends of the glass tube 1 are sealed by the pair of sealing electrodes 2.

However, for the above-mentioned conventional ***surge absorber,*** the following problems remain. That is, in this ***surge absorber, when the surge absorber*** element is inserted into the hole of the carbon heater jig during production, the ***surge absorber*** element leans to one side, resulting in a situation where the central axis of the ***surge absorber*** element is misaligned to the central axis of the glass tube. When the ***surge absorber*** element is sealed in this misaligned condition, the ***surge absorber*** element touches the glass tube, so that at the time of discharge, the conductive film disintegrates and is easily adhered to the

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glass tube, resulting in a situation where the life span of the ***surge absorber*** element and the surge current capacity is lowered. In addition, because the electrodes are installed into both ends, the ***surge absorber*** element has a high cost. Moreover, the ***surge absorber*** is lengthened by an amount of the electrodes.

Furthermore, in this ***surge absorber,*** because an easily acquired and inexpensive cylindrical glass tube is used, this rolls easily when mounted on a flat substrate or the like, and cannot be secured in position unless secured with an adhesive or metal fitting. Hence there is a deficiency in work efficiency at the time of mounting.

The present invention take the above problems into consideration, with a first object being to provide a ***surge absorber*** and a production method therefor whereby the ***surge absorber*** element can be positioned in the center of the glass tube with high accuracy, the life span and the surge current capacity of the ***surge absorber*** can be improved, and low cost and small size can be achieved. Moreover, a second aim is to provide a surge absorber with superior installation work efficiency, that does not roll easily.

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SUMMARY OF THE INVENTION

A first aspect of the present invention relates to a ***surge absorber*** provided with; a ***surge absorber*** element composed of a columnar non-conductive member and a conductive film formed dividedly via a discharge gap on a peripheral surface of the nonconductive member, a pair of sealing electrodes disposed at opposite ends of the ***surge absorber*** element and touching the conductive film, and a glass tube with opposite ends closed by the pair of sealing electrodes and the ***surge absorber*** element and an inert gas encapsulated thereinside, and is characterized in that a face of each sealing electrode which contacts with the surge absorber element is formed in a concave shape symmetrical with a central axis of the glass tube.

A second aspect of the present invention relates to a production method for a ***surge absorber provided with; a surge absorber*** element composed of a columnar nonconductive member and a conductive film formed dividedly via a discharge gap on a peripheral surface of the non-conductive member, a pair of sealing electrodes disposed at opposite ends of the ***surge absorber*** element and touching the conductive film, and a glass tube with opposite ends closed by the pair of sealing electrodes and the ***surge absorber*** element and an inert gas encapsulated thereinside. The production method is characterized in having; an insertion step for inserting one of the pair of sealing electrodes, the glass tube, the ***surge absorber*** element, and the other of the pair of sealing electrodes in this order into a hole formed in a production jig of an internal diameter into which the glass tube can be inserted; and a welding step involving replacing an atmosphere gas inside the hole with an inert gas and then welding the sealing electrodes to the glass tube inside the hole by heating the production jig, and a face of each sealing electrodes inserted in the insertion step which contacts with the ***surge absorber*** element is formed in a concave shape symmetrical with a central axis of the glass tube which is inserted.

A third aspect of the present invention relates to a ***surge absorber*** provided with; a ***surge absorber*** element composed of a columnar non-conductive member and a conductive film formed dividedly via a discharge gap on a peripheral surface of the non-conductive member, a pair of sealing electrodes disposed at opposite ends of the ***surge absorber*** element and touching the conductive film, and a glass tube with opposite ends closed by the pair of sealing electrodes and the ***surge absorber*** element and an inert gas encapsulated thereinside, and is characterized in that a flat portion is formed on at least one portion of an outer peripheral surface of the glass tube.

In this case, preferably at least a pair of the flat surfaces are formed in parallel on opposite sides of the

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glass tube. Moreover, more preferably a transverse section of the glass tube is a square shape touching an outer periphery of the pair of sealing electrodes.

Furthermore, preferably a ratio of a transverse section area of the surge absorber element to a transverse section area of an inner space of the glass tube is from 1:3 to 1:15.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-section showing a first embodiment of a ***surge absorber*** according to the present invention.

FIG. 2 is a perspective diagram showing an upper and lower carbon heater jig in a first embodiment of a production method for a ***surge absorber*** according to the present invention.

FIG. 3A is a perspective diagram showing a jig for inserting lead wires in the first embodiment of the production method for a ***surge absorber*** according to the present invention.

FIG. 3B is a perspective diagram showing a jig for inserting glass tubes in the first embodiment of the production method for a ***surge absorber*** according to the present invention.

FIG. 3C is a perspective diagram showing a jig for inserting ***surge absorber*** elements in the first embodiment of the production method for a surge absorber according to the present invention.

FIG. 4 is a cross-section showing a condition of each portion inserted inside holes in the first embodiment of the production method for a surge absorber according to the present invention.

FIG. 5 is a perspective diagram showing a condition wherein the upper carbon heater jig and the lower carbon heater jig are superposed, in the first embodiment of the production method for a ***surge absorber*** according to the present invention.

FIG. 6 is a perspective diagram showing a condition wherein a weight jig is set on the superposed upper carbon heater jig and lower carbon heater jig, in the first embodiment of the production method for a ***surge absorber*** according to the present invention.

FIG. 7 is a cross-section showing a modified example of the first embodiment of the ***surge absorber*** according to the present invention.

FIG. 8 is a cross-section showing a second embodiment of a ***surge absorber*** according to the present invention.

FIG. 9 is a perspective diagram of the ***surge absorber*** shown in FIG. 8.

FIG. 10 is an explanatory drawing shown in cross-section for explaining a discharge space in the ***surge absorber*** shown in FIG. 8.

FIG. 11 is a perspective diagram showing an example of a conventional surge absorber.

FIG. 12 is a cross-section showing an example of a condition of each portion inserted into a hole portion, in the conventional ***surge absorber*** and the production method thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

3-3 [redacted] p-10

First Embodiment

A first embodiment of a ***surge absorber*** according to the present invention will be described with reference to FIG. 1.

The ***surge absorber*** of the present embodiment is a discharge ***surge absorber*** which uses so-called microgaps. This is provided with; a ***surge absorber*** element 211 composed of a columnar shaped ceramics member (non-conductive member) wherein a conductive film 210 such as an SnO.sub.2 film is dividedly formed via a microgap M (discharge gap) on a peripheral surface, a pair of sealing electrodes 212 forming a column and which touch the conductive film 210, oppositely arranged at both ends of the surge absorber element 211, and a glass tube 213 with opposite ends closed by the sealing electrodes 212, and the ***surge absorber*** element 211 and an inert gas G such as He, Ar, Ne, Xe, SF.sub.6, CO.sub.2, C.sub.3 F.sub.8, C.sub.2 F.sub.6, CF.sub.4, H.sub.2 or a mixture of these gases encapsulated thereinside.

The sealing electrodes 212 are made of Dumet (FeNi alloy), and are welded to the opposite ends of the glass tube 213 by high temperature heating. The ***surge absorber*** element 211 is enclosed such that the central axis thereof coincides with the central axis of the glass tube 213 as explained below. In addition, the contact surfaces 212a of the sealing electrodes 212 which contact with ***surge absorber*** element 211 are formed in a concave shape symmetrical with a central axis C of the glass tube 213. That is, the glass tube 213 and the pair of sealing electrodes 212 are secured with the center of the contact surfaces 212a and the central axis C of the glass tube 213 coinciding.

Regarding the microgap M, the conductive film 210 is formed on the surface of the ceramics member of a mullite sintered body or the like by a film forming technique such as; a sputtering method, an evaporation method, an ion-plating method, a plating method or a CVD method. The conductive film 210 is then irradiated and removed with a laser light to divide the conductive film 210 and form the microgap M to a width of approximately 10 to 200 .mu.m.

In this ***surge absorber,*** one of the sealing electrodes 212 and one of the conductive films 210 are connected electrically, and the other sealing electrode 212 and the other conductive film 210 are connected electrically. Furthermore, the one conductive film 210 and the other conductive film 210 are electrically insulated by the microgap M. Therefore, when an intermittent excess voltage or excess current penetrates the ***surge absorber,*** it is estimated that the opposite conductive films 210 in the microgap M suffer thermal damage and the width of the micro gap M is widened. As a result the discharge maintenance voltage is increased and the discharge stops.

Moreover, in the ***surge absorber*** of the present embodiment, since the electric field is concentrated at the circumference portion 212b of the contact surface 212a of the sealing electrodes 212, performing the role of the conventional cap electrodes, this has a similar discharge effect even without cap electrodes, and discharge is possible at the circumference portion 212b. Furthermore in this situation, because the circumference portion 212b where the discharge is performed is far from the outer periphery of the ***surge absorber*** element 211, it is possible to extend the discharge space more than when using a cap electrode, so that it is possible to improve the lifespan and the surge current capacity of the ***surge absorber***. Moreover, because the cap electrode is unnecessary, it is possible to devise a ***surge absorber*** that is smaller and less expensive than a ***surge absorber*** that uses cap electrodes.

Next is a description of a production method for the ***surge absorber*** of the present embodiment with reference to FIG. 2 through to FIG. 6.

The above-mentioned ***surge absorber*** has been described using a melph type. However, this production method is described using a lead wire type wherein lead wires L are provided beforehand in the sealing electrodes 212.

At first, as shown in FIG. 2, the one sealing electrodes 212 fitted with lead wires L are inserted into a plurality of hole portions 220a provided in the upper carbon heater jig (production jig) 220. At this time, these are inserted with the lead wire L directed downwards.

On the other hand, as shown in FIG. 3A to FIG. 3C, the other sealing electrodes 212 fitted with lead wires L, the glass tubes 213 and the surge absorber elements 211 are inserted in this order into the plurality of hole portions 221a provided in the lower carbon heater jig 221 using the jigs 222, 223 and 224 respectively. At this time also, the sealing electrodes 212 are inserted with the lead wires L directed downwards.

As shown in FIG. 4, in the hole portions 220a and 221a of the upper and lower carbon heater jigs 220 and 221 small diameter portions 220b and 221b through which only the lead wires L can pass are respectively formed in the lower portions, and when the sealing electrodes 212 are inserted, the lead wires L are in condition protruding from the lower surfaces of the jigs 220 and 221.

In addition, the internal diameter of the opening portion of the hole portion 221a of the lower carbon heater jig 221 is set at a size at which the glass tube 213 can be just inserted.

Here, as mentioned above, the contact surface 212a of the sealing electrode 212 is formed in a concave shape symmetrical with a central axis C of the glass tube 213. Therefore, as shown in FIG. 4, at the time of insertion the ***surge absorber*** element 211 does not lean to one side. As a result the central axis of the ***surge absorber*** element 211 can be made to coincide with the central axis C of the glass tube 213 easily and with high accuracy.

Subsequently, as mentioned above, the upper faces of the upper carbon heater jig 220 and the lower carbon heater jig 221 are superposed on each other as shown in FIG. 5 so that the mutual hole portions 220a and 221a thereof with the respective members inserted thereinside coincide. At this time as shown in FIG. 4, the other sealing electrodes 212 are fitted into the upper opening portions of the glass tubes 213.

In this situation, as shown in FIG. 6, the weight jig 225 is set on the upper carbon heater jig 220. This weight jig 225 is set so as to mount columnar weight members 225a on the upper ends of the lead wires L protruding from the upper portion, so as to apply a fixed load to the lead wires L.

In the situation with the weight jig 225 set, the upper and lower carbon heater jigs 220 and 221 are set inside an enclosing machine (omitted from the figures), the atmosphere gas inside is replaced with a predetermined inert gas G, and then the opposite ends of the glass tube 213 and the pair of sealing electrodes 212 are welded by heating the upper and lower carbon heater jigs 220 and 221, and the ***surge absorber*** element 211 and the inert gas G are encapsulated thereinside.

After the encapsulation has been completed in this way, the weight jig 225, and the upper and lower carbon heater jigs 220 and 221 are removed, and the completed surge absorbers taken out from the lower carbon heater jig 221, thus completing the production.

In the production method for the ***surge absorber*** of the present embodiment, the contact surfaces 212a of the sealing electrodes 212 are formed in a concave shape symmetrical with a central axis C of the glass tube 213. Therefore, when the ***surge absorber*** elements 211 are inserted, the central axis of the

surge absorber element 211 can be made to coincide with the central axis C of the glass tube 213 with high accuracy. As a result, the ***surge absorber*** element 211 is positioned accurately, enabling a surge absorber with a long lifespan and a high surge current capacity to be obtained.

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The technical scope of the present invention is not limited to the above embodiments, and various modifications can be added within a scope which does not depart from the gist of the invention.

For example, in the above-mentioned embodiment, the shape of the contact surface 212a of the sealing electrodes 212 is a cross-sectional U shaped concave surface, but this may also be other concave shapes. For example, the contact surface may be a cross-sectional V shaped concave surface symmetrical with the central axis of the glass tube in which the sealing electrodes are inserted. Moreover, the bottom of the concave surface may be a flat surface.

In addition, in the above-mentioned embodiment, the circumference portion 212b of the sealing electrodes 212 is in the form of an angle point, but in another embodiment as shown in FIG. 7, a circumference portion 232b of the sealing electrodes 232 may also be in a flat shape (or with rounded corners). Furthermore, as in the example shown in FIG. 7, a circumference portion 232b of rectangular shape in cross-section may be protruded with a step formed between the contact surface 232a of the sealing electrodes 232 and the circumference portion 232b. Needless to say, the above-mentioned ***surge absorber*** and the production method therefor may be applied to both a ***surge absorber*** of a melph type with no lead wires and a ***surge absorber*** of a type having lead wires.

Second Embodiment

Hereunder is a description of a second embodiment of a ***surge absorber*** according to the present invention with reference to FIG. 8 through to FIG. 10. The ***surge absorber*** of the present embodiment is similar to the above-mentioned first embodiment, being a so-called discharge type surge absorber that uses microgaps. As shown in FIG. 8, this is provided with; a ***surge absorber*** element 111 composed of a columnar ceramics member (non-conductive member) wherein a conductive film 110 formed dividedly via a microgap M on a peripheral surface; a pair of cap electrodes 112 disposed facing opposite ends of the ***surge absorber*** element 111 and touching the conductive film 110, a pair of sealing electrodes 113 formed in a column disposed on the outer side of the cap electrodes 112, and a glass tube 114 with opposite ends closed by the sealing electrodes 113, and the ***surge absorber*** element 111 and an inert gas G encapsulated thereinside. In addition, the ***surge absorber*** element 111 is encapsulated so that the central axis thereof coincides with the central axis of the glass tube 114.

The glass tube 114 is formed from lead glass or the like, and as shown in FIG. 9, the transverse section shape is made in a quadrangle shape (square) touching the outer periphery of the pair of sealing electrodes. As a result, it has four flat portions 114a on the outer peripheral surface. In addition, the ratio of a transverse section area of the surge absorber element 111 to a transverse section area of the inner space of the glass tube 114 is set at from 1:3 to 1:15, and in the present embodiment is set at 1:14.

The materials for the conductive film 110, the sealing electrodes 113, the inert gas G and the glass tube 114, and the method of forming the microgap M, and moreover, the discharge prevention mechanism of the ***surge absorber*** are all the same as for the above-mentioned embodiments.

In the ***surge absorber*** of this embodiment, because the flat portions 114a are formed on the outer peripheral surface of the glass tube 114, then by positioning on a flat board such as a print board with the flat portion 114a downwards, the ***surge absorber*** is difficult to roll, enabling installation work efficiency of the ***surge absorber*** to be improved.

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In addition, because the flat portions 114a on opposite sides of the glass tube 114 are made parallel, there is also a flat portion 114a on the side (upper side) opposite to the flat portion 114a of the side that is placed on top of the flat board. Therefore, by performing vacuum aspiration for the flat portion 114a the ***surge absorber*** can be easily held, facilitating automation of mounting.

Moreover, the transverse section shape of the glass tube 114 is a quadrangle shape (that is, an overall square shape) which touches the outer periphery of the sealing electrodes 113. Therefore, between the ***surge absorber*** element 111 and the glass tube 114, that is on inside of the corner of the glass tube 114, a wide discharge space S results (the region shown by the grid lines in FIG. 10 is the increment of the discharge space S). Because of this, the life span and the surge current capacity of the ***surge absorber*** is increased.

Furthermore, the ratio of the transverse section area of the ***surge absorber*** element 111 to the transverse section area of the inner space of the glass tube 114 is 1:14. However, this ratio is for a necessary and sufficient glass tube size to ensure the most effective surge life-span and surge current capacity for the size (transverse section area) of the surge absorber element 111.

Incidentally, in contrast to types that use conventional cylindrical glass tubes, the ***surge absorber*** of the present embodiment improves the lifespan by 50% in the case where for example a 100A current is applied by an 8/20 .mu.s surge current wave. In addition, in the case where the current is applied by an 8/20 .mu.s surge current wave, the surge current capacity is improved 100%.

The technical scope of the present invention is not limited to the above embodiments, and various modifications can be added within a scope which does not depart from the scope of the invention.

For example, in the above-mentioned embodiment, the transverse section shape of the glass tube 114 is a square shape, but provided there is a flat portion 114a on at least one part of the outer peripheral surface, other transverse section shapes may be used. For example, the transverse section of the glass tube may also be in the form of a triangle. However, if the opposite flat portions 114a are made parallel, then as mentioned above, vacuum attraction can be easily implemented, facilitating automation of mounting. Hence it is preferable to make the shape of the transverse section of the glass tube a quadrangle shape.

Moreover, in the above embodiment, the present invention was applied to a melph type ***surge absorber,*** but this may also be applied to surge absorbers with lead wires attached to the sealing electrode. It is of course also possible to make a transverse section shape of the glass tube 213 in the first embodiment the same as the transverse section shape of the glass tube 114 in the second example.

In addition, in each of the above embodiments, a mullite sintered body was used for the ceramics member, but a non-conductive ceramics such as alumina, beryllia, stellite, forsterite, zircon, ordinary porcelain, glass ceramics, silicon nitride, aluminum nitride or silicon carbide may be used.

* * * * *

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Surge Absorbers

Surge Absorbers Introduction

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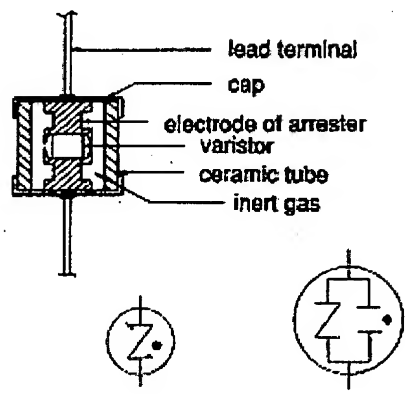
• CONSTRUCTION



Symbol Equivalent Circuit Diagram

SURGE

Power surges, both voltage and current, are occurring continually in today's power systems. Whether they occur naturally, such as from lightning and static electricity; or are man made, such as inductive surges from motor, transformers, solenoids, etc. power surges are a fact of life. These power surges have a very high voltage and current level as compared to electrical noise.

Recent developments in electronic designs have tended toward smaller and higher density packaging of circuitry. This results in a greater susceptibility to surges. Once attacked by a surge, electronic circuits can be destroyed in as short as 0.1 psec. The designer of electronic equipment must be aware of, and be able to deal with, power surges in product design.

OKAYA's RAV surge absorbers are designed to assist in dealing with the problem of power surges. The RAV series is a unique new approach which combines the features of two well known technologies. Combining the high speed capabilities of Metal Oxide Varistor (MOV) with the large power handling capability of Gas Arrester, OKAYA has developed a product which can clamp power surges faster than gas arrester alone and handle large power surges far beyond the capability of MOV.

FEATURES

The RAV Surge Absorber is applicable for the protection of many types of electrical equipment.

The RAV has the following features:

1. Large capacity surge protection
2. Fast response time
3. Good endurance to repetitive lightning

4. High clipping performance
5. Low internal capacitance
6. No environmentally hazardous materials

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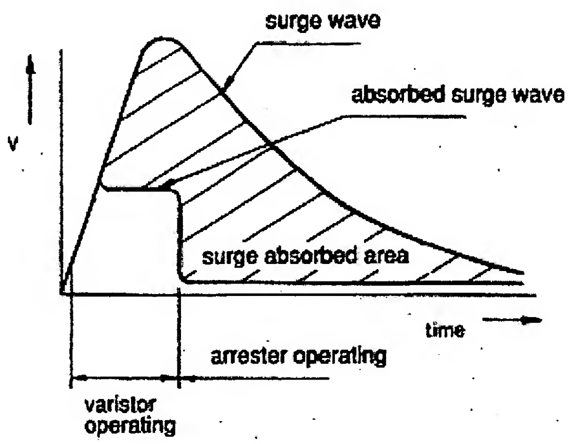
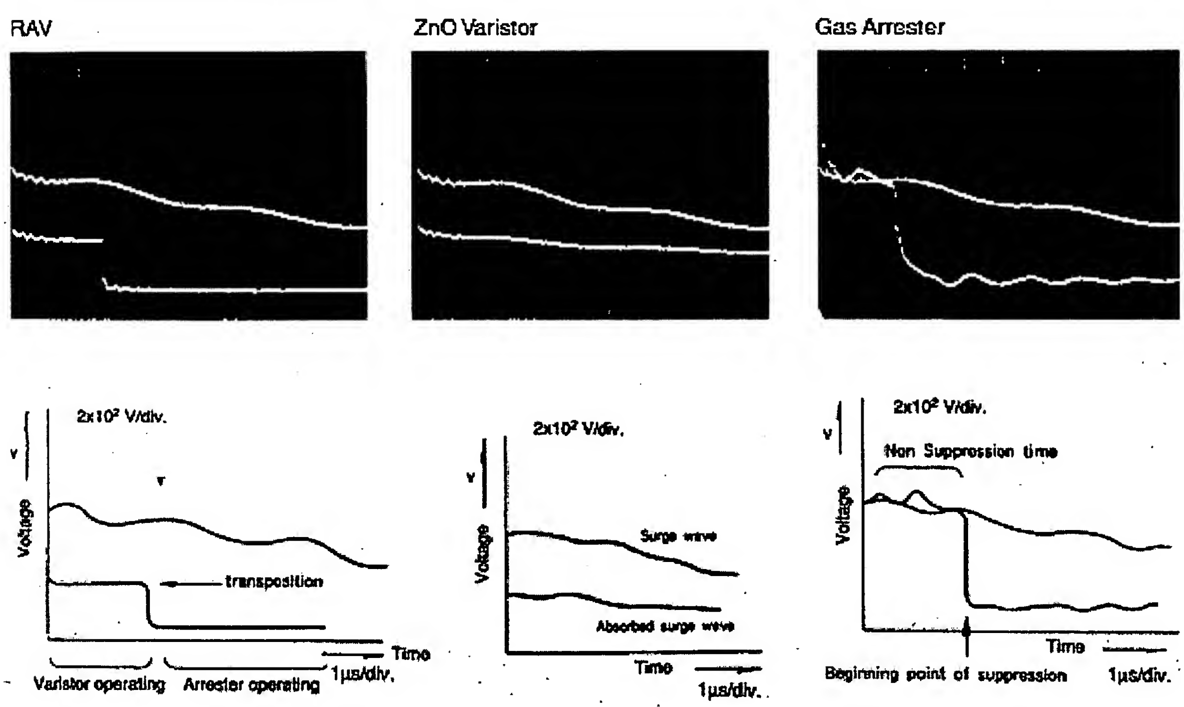


OPERATING PRINCIPAL

The RAV connected between lines will shunt the surge from one side of the line to the other. The high speed varistor quickly shunts the surge until the slower, but more powerful gas arrester takes over. This allows the gas arrester to handle the high energy portion of the surge and protect the MOV from damage. This interaction of the RAV assures safe handling of the power surge and long life stability to the MOV.

DYNAMIC CHARACTERISTICS

Fig. 1 Shows the dynamic characteristics of Varistor, Gas Arrester & RAV.



Lightning surges have precipitous dv/dt values and huge electrical

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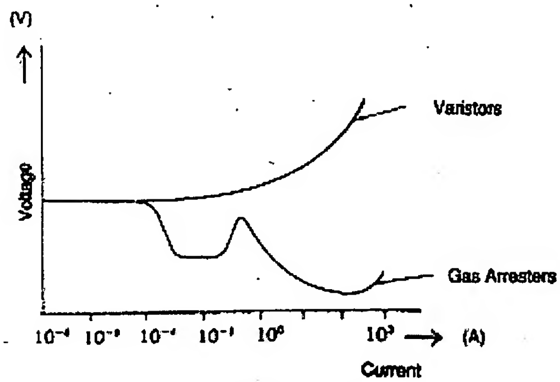
charge. Surge absorbers must assimilate this surge. This limiting voltage capability varies depending upon the type of absorber. The voltage and current curves in Fig. 2 characterize varistors and gas arresters.



Voltage Vs Current Curves

Figure 2

VARISTORS

Varistor voltage is specified by the manufacturer at low current (ie, 0.1-1.0 mA). The clamping voltage of the Varistor at higher current (ie, 1.0 Amp) can be several times higher and will increase as the current goes higher (See Fig. 2).

Varistors have a very fast response time (ie, 50 nsec.) and will clamp at rated voltage for low currents or short periods of time. However, as a power surge increases in either current or duration, the Varistor clamping voltage can rise to unsafe levels, ultimately failing when its maximum energy level is exceeded. Although the Varistor may survive most power surges, each time it absorbs a power surge, damage occurs to the Varistor. Ultimately the MOV is rendered inoperative and unable to perform its suppression task.

GAS ARRESTERS

The rated voltage of the Gas Arrester is defined as a DC breakdown Voltage (Ez). In contrast to the Varistor, as the surge current increases this voltage decreases. Therefore, once the Gas Arrester is triggered, the voltage level is maintained at a safe level, regardless of the increase in current or duration of the power surge. Typically the trigger response time is1 µs.

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Okaya Surge Absorbers

RA Series

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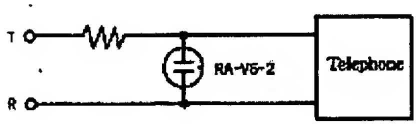
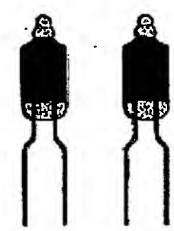
Description

The RA-V6-2 series utilizes creeping corona discharge, thus demonstrating extremely fast response characteristics in dark ambient conditions without the use of radioactive isotopes. For example, a 1.2/50μs, 10kV surge voltage can be suppressed to about 1 kV.

Applied as indirect lightning surge protection in telephone equipment, this model is used for parallel connection between T and R in telephone receivers. Also, by connecting this absorber within electronic circuits, network computers can be protected from destructive impulse current.





Electrical Specifications

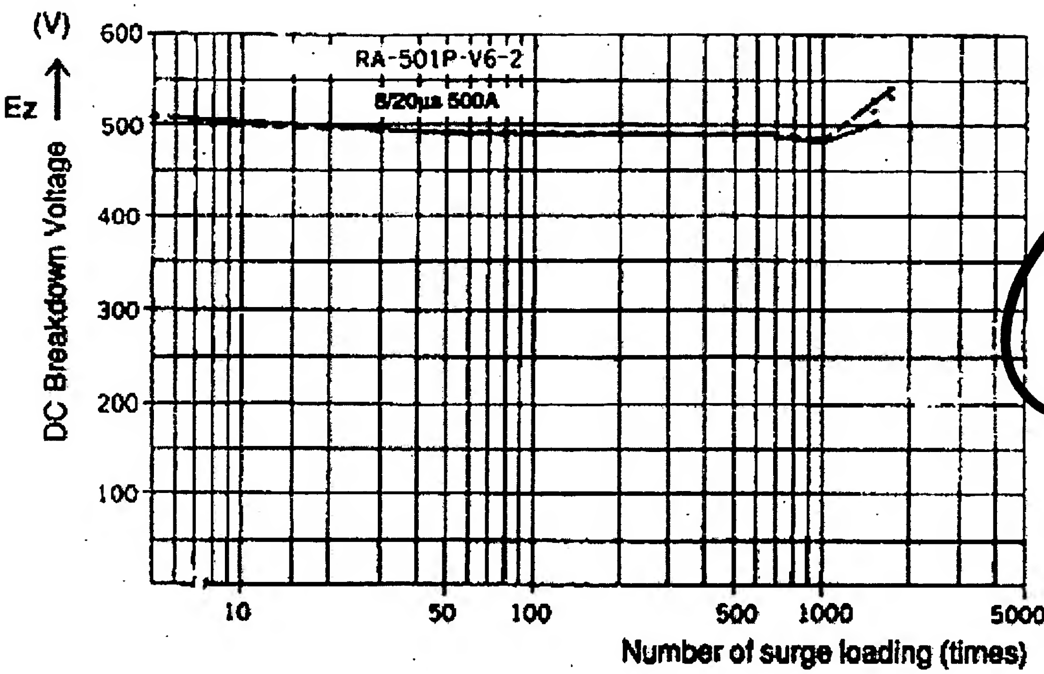
Model No	DC Breakdown Voltage (when lighted) (V)	Peak Surge Current 8/20us(A)	Capacitance (pf)	Dimensions (mm) A	Dimensions (mm) B	Dimensions (mm) C	Operating Temp Range (C)
RA-201P-V6-2	200 ±15%	1500	2 Max.	6.5 Max	14.0 Max	0.45± 0.05	20° to +70°
RA-231P-V6-2	230±15%						
RA-261P-V6-2	260±15%						
RA-301P-V6-2	300±15%						
RA-311P-V6-2	310±15%						
RA-351P-V6-2	350±15%						
RA-391P-V6-2	390±15%						
RA-501M-V6-2	500±15%						
RA-201M-V6-2	200±15%						
RA-231M-V6-2	230±15%						

RA-261M-V6-2	260±15%	1500	2 Max.	6.5 Max	14.0 Max	0.45± 0.05	20° to +70°
RA-301M-V6-2	300±15%						
RA-311M-V6-2	310±15%						
RA-351M-V6-2	350±15%						
RA-391M-V6-2	390±15%						
RA-501M-V6-2	500±15%						

5-7

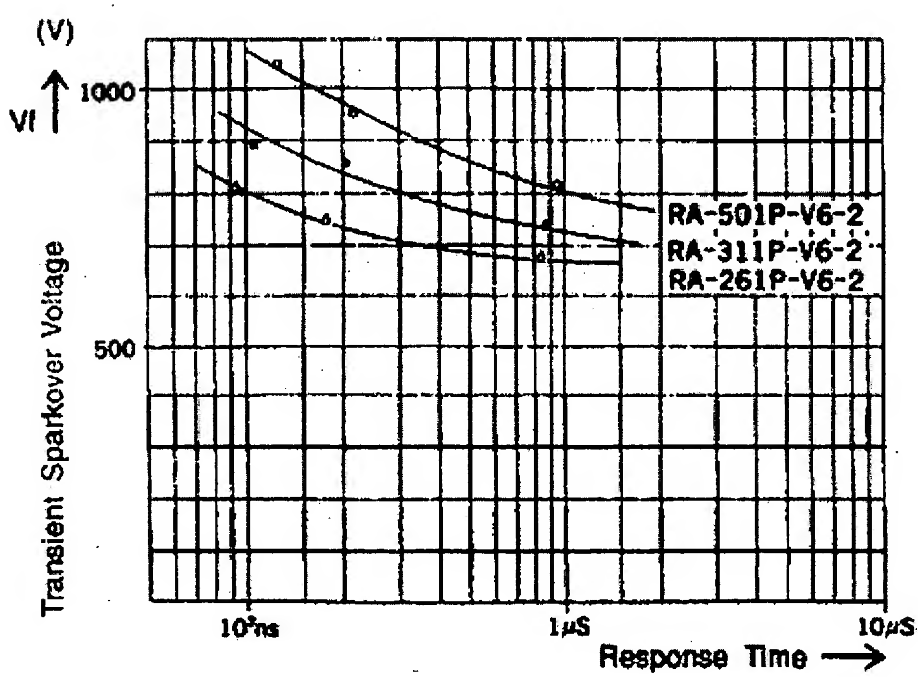
Features:

- Fast response time.
- This Surge Absorber is bipolar. The device will fail open if the surge withstand capability is exceeded.
- Inter-terminal capacity is extremely small, resulting in little influence on electronic circuits.
- High insulation resistance ($1X10^9$ ohms or more).
- Repeatable: may be used up to 300 times at 500A (8/20μs).
- Small size allows soldering together with resistors or other electronics components.
- Product available taped for auto insertion. Add "Y" to model number (RA-201 P-V6Y-2).



5-8

Impulse Circuit Endurance Characteristics



V - T Characteristics

comm-omni@comm-omni.com COMM-OMNI INTERNATIONAL

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To speak to one of our consultants, please call us at 1-800-543-8790

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Passive&Electromechanical

ZNR Transient/Surge Absorbers

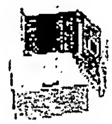
Lineup | Parametric search

5-10

[► ZNR Transient/Surge Absorbers Data Files Are Here]

Be sure to read the following Caution and Warning

Series/Type	Catalog	style	Parts No	Features	Varistor Voltage	Maximum Peak Current	Other Files
-	-	-	-	-	V	A	-
► ZNR Transient/Surge Absorbers Series:D Type:V	PDF		ERZVxxxxxxxx	Standard type with radial leads for general surge protect applications	18 to 1800	125 to 7000	FILES
► ZNR Transient/Surge Absorbers, SMD Type	PDF		ERZVFxMxxxx	Surface mount type with protective coating so as to high leve; reliability	22 to 470	50 to 600	FILES
► UL and CSA Recognized ZNR Treansient/Surge Absorber with Tab	PDF		ERZCxxCKxxx	UL and	200 to 1100	5k to 25k	FILES
► ZNR Transient/Surge Absorbers	PDF		ERZCxxEKxxx	For an application in industrial electric or electronic equipment under heavy duty		5 to 25k	FILES
► ZNR transient/surge Absorbers Type:P	PDF		ERZAxxPKxxx	Plug-in type with deterioration indicator For application to industrial equipment	250 to 1000	5000	FILES
► ZNR Transient/Surge	PDF		ERZAxxJKxxx	Stack-type for heavy surge	560 to 1250	80 to 320kA	FILES

Absorbers Type:J				energy application(High power induced load and so on)			
► ZNR Transient/surge absorgers Type:G	PDF		ERZAxxGxxxx	For protection to switching surge of high voltage (3.3,6.6kV) equipment	5 to 17kV	5 to 10kA	FILES
► Surge Absorber Units	PDF		ERZAxxxxxxx	Surge absorber with connected ZNRs and circuit breaker in box	22 to 1000	5 to 50kA	FILES
► ZNR	-		ERZUV2D391G				FILES
► ZNR Transient/Surge Absorbers,For Thyristor Protection	PDF		ERZC20EKxxxP ERZC32EKxxxP ERZUxxJPxxx	Thristor protection against swithing surge transformer	510 to 2500	40 to 210	FILES

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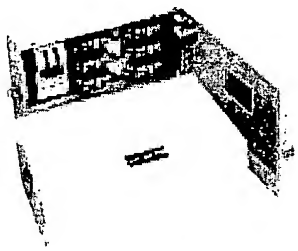
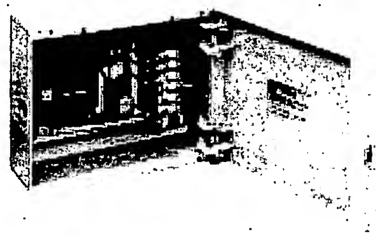
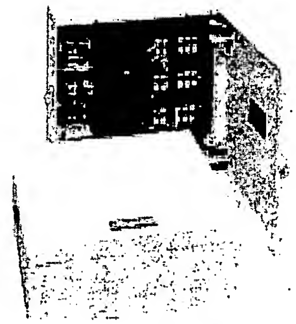
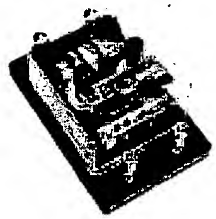
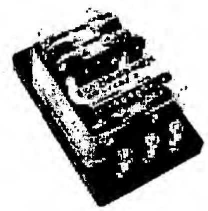
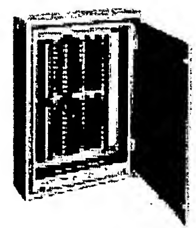
[Screen Top]

Terms of Use Privacy

"ZNR"
Surge Absorber Units

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The Surge Absorber Unit contains Y, Δ or π connected ZNRs surge absorbers (and, if necessary, a circuit breaker) in a box.
These Surge Absorber Units are designed for surge protection of industrial electric equipment where reliability is essential.

■ Recommended Applications

Surge Protection of

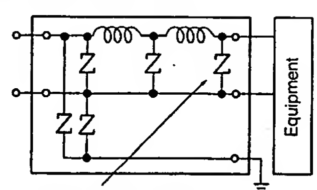
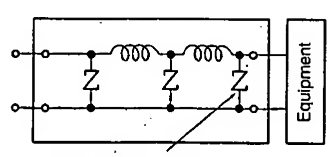
- Railway/traffic signal control systems
- Distribution line control systems
- Broadcasting systems, communication systems
- Measuring instruments
- Controllers of low voltage distribution line
- Controllers of waterworks

Note: Ask our factory for Product Specification before use.

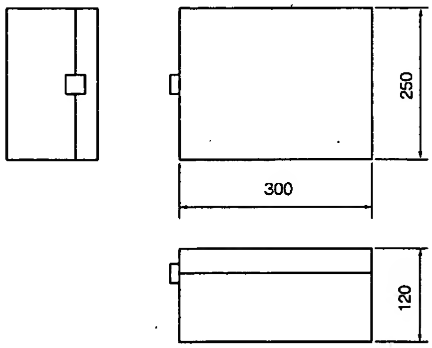
■ ZNR Surge Absorber Units

Application	Maximum Peak Current	Rated Voltage	Circuits: Single-phase two-wire system Part No.	Dim.	Connection	Single-phase three-wire system Part No.	Dim.	Connection	Three-phase three-wire system Part No.	Dim.	Connection	Three-phase four-wire system Part No.	Dim.	Connection
For Power Source	5000 A	AC 100/ 120 V	ERZA1P251ASA	A	1	ERZA2P251ASA	B	2				ERZA4P251ASA	[illegible]	4
			ERZA1P251BC*	C	5									
			ERZA1P251AR**	C	6									
		AC 200/ 220/240 V	ERZA1P501AS	A	1	ERZA2P501AS	B	2	ERZA3P501AS	B	3	ERZA4P501AS	B	4
		AC 400/ 440 V	ERZA1P102AS	B	1				ERZA3P102AS	B	3	ERZA4P102AS		4
	20000 A	AC 100/ 120 V	ERZA1E271ASA	A	7	ERZA2E271AS	B	8				ERZA4E271AS	B	10
		AC 200/ 220/240 V	ERZA1E471ASA	A	7	ERZA2E471AS	B	8	ERZA3E471AS	B	9	ERZA4E471AS	B	10
		AC 400/ 440 V	ERZA1E102AS	B	7				ERZA3E102AS	B	9	ERZA4E102AS	B	10
	50000 A	AC 100/ 120 V	ERZA1E271BS	B	7	ERZA2E271BS	B	8				ERZA4E271BS	B	10
		AC 200/ 220/240 V	ERZA1E471BS	B	7	ERZA2E471BS	B	8	ERZA3E471BS	B	9	ERZA4E471BS	B	10
		AC 400/ 440 V	ERZA1E102BS	B	7				ERZA3E102BS	B	9	ERZA4E102BS	B	10

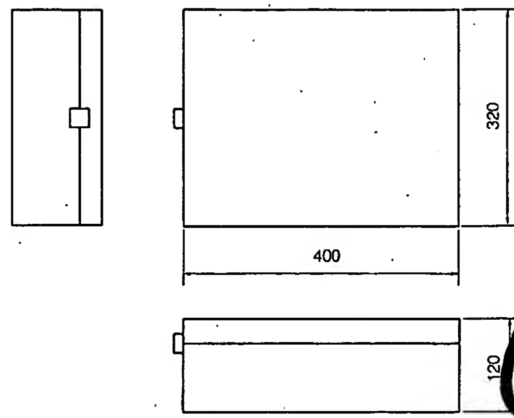
*π connection with inductors (specified current: 2 A)
**π connection with resistors (specified current: 2 A)

Application	Maximum Peak Current	Rated Voltage	Part No.	Dimensions	Connection
For signal system (Line to Line and Line to Ground use)	5000 A	DC 12 V	ERZA5F220AC	D	Coil: 1 mH max. Max. continuous current: 0.6 A  Type D (other : Type E)
		DC 24 V	ERZA5F390AC		
		DC 48 V	ERZA5F680AC		
		DC 80 V	ERZA5F101AC		
		DC 100 V	ERZA5F201ACA		
For signal system (Line to Line use only)	5000 A	DC 12 V	ERZA5F220BC	C	Coil: 1 mH max. Max. continuous current: 0.6 A  Type D (other : Type E)
		DC 24 V	ERZA5F390BC		
		DC 48 V	ERZA5F680BC		
		DC 80 V	ERZA5F101BC		
		DC 100 V	ERZA5F201BC		

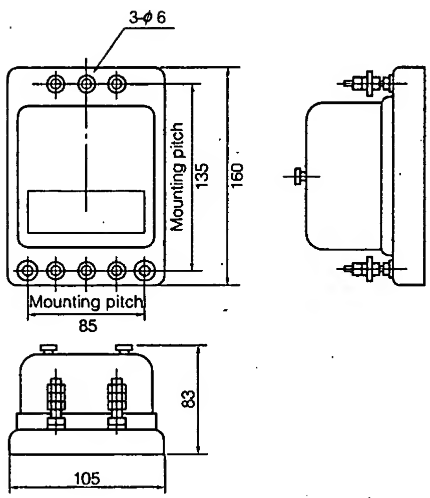
■ Dimensions in mm (not to scale)



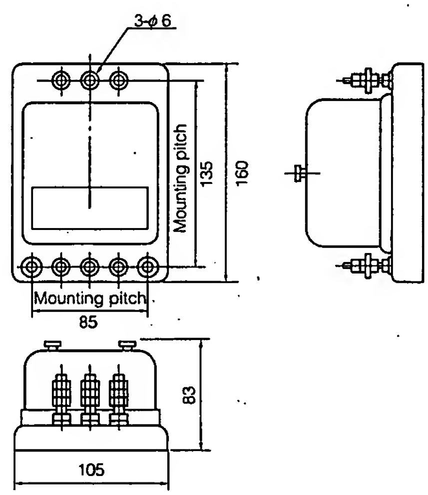
(A)



(B)

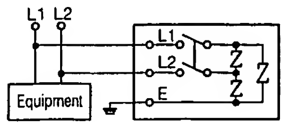


(C)



(D)

■ Circuit Diagrams



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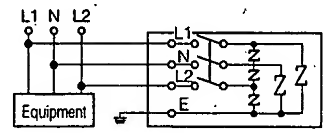

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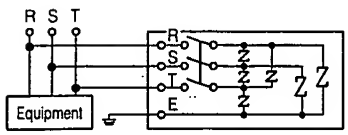

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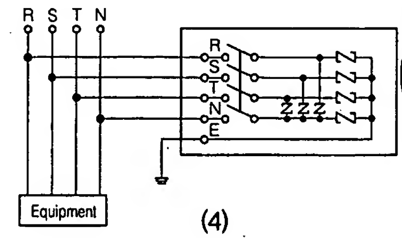

(4)

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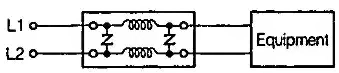
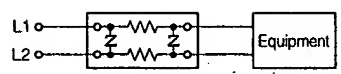
Inductance : 1 mH max.



Max. continuous current : 2 A

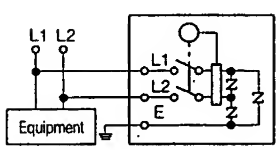
(5)

Resistance : 0.3 Ω



Max. continuous current : 2 A

(6)



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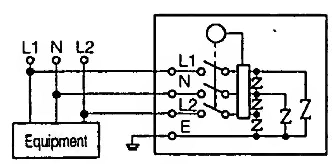

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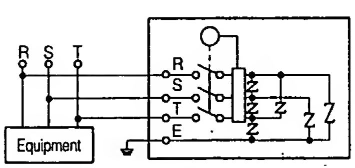

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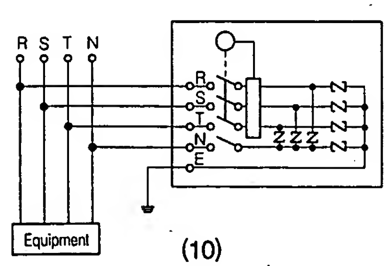

(10)

TRANSISTOR, DIODE

SE

NSAD Series
Surge Absorber Device

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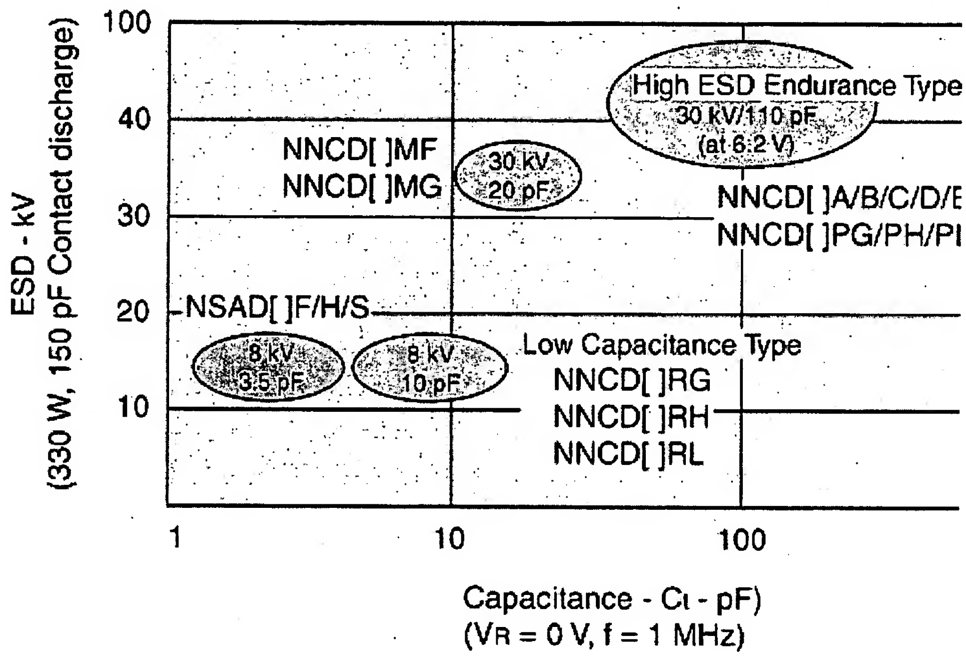
Product Line-up : NSAD500F/H/S .

ESD (IEC61000-4-2) vs. Capacitance

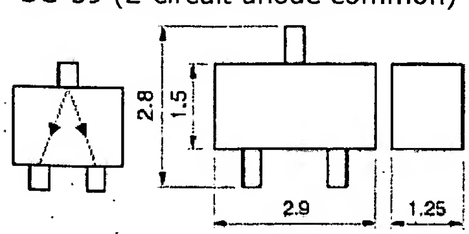


NSAD assures an endurance of no less than 30 kV, based on the IEC61
EMI.

> Product name and Package

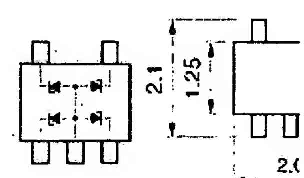
NSAD500F

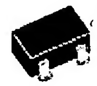
SC-59 (2-circuit anode common)



NSAD50

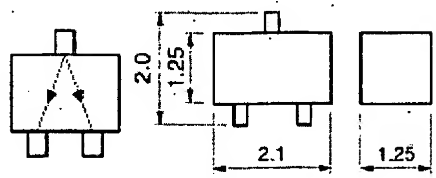
SC-88A (4-circuit anod





NSAD500S

SC-70 (2-circuit anode common)



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ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Rating	Unit	Re
Power Dissipation	P	200 (S type 150)	mW	Tot
Junction Temperature	Tj	150	degree	
Storage Temperature	Tstg	-55 to +150	degree	

Electrical Characteristics (T_A= +25 degree)

Break Over Voltage V_{BO} (V)		Capacitance Ct (pF)		Reverse Current I_F (uA)		ESD (kV)		<I Forwa
MIN.	TYP.	TYP.	Condition	MAX.	V_F (V)	MIN.	Condition	
5.3	8	3.5	V_R= 0V f = 1MHz	0.1	3.0	8	C = 150pF R = 330ohm (IEC61000-4-2)	1

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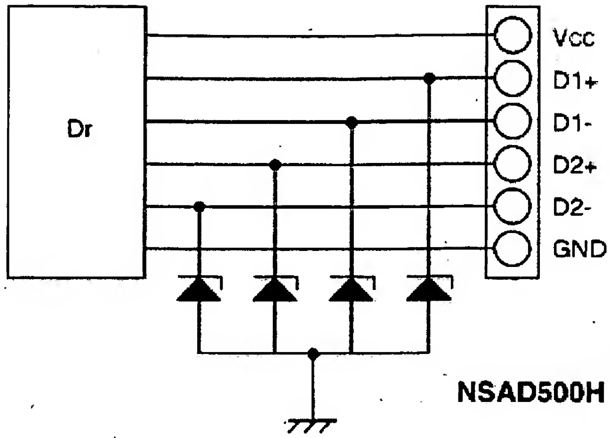
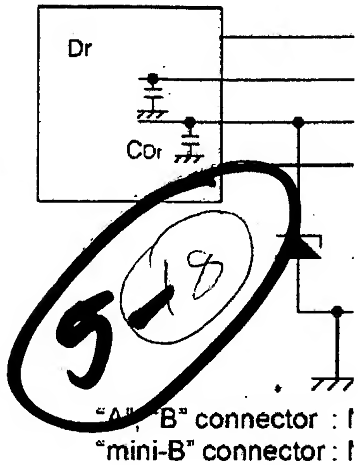
Circuit Example

(1) IEEE1394a (400 Mbps) **(2) USB2.0 (48**

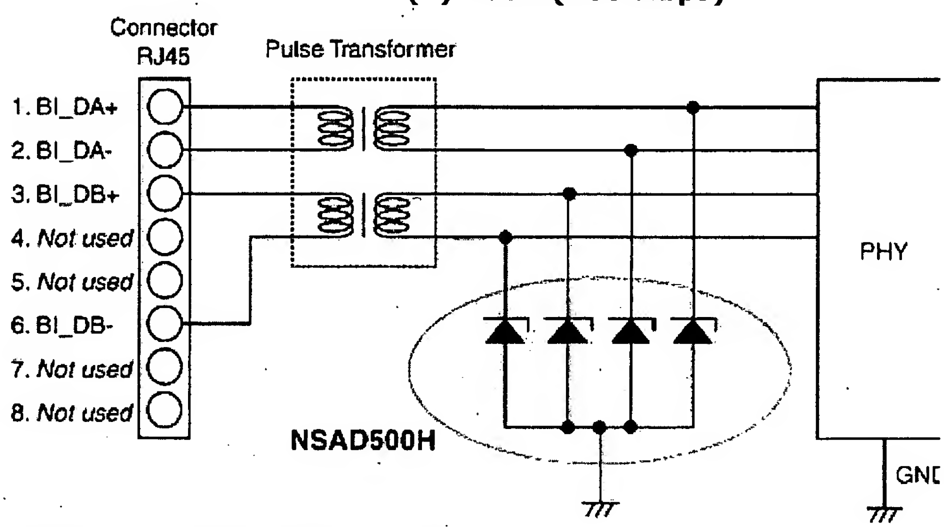




Data-Line Input Signal Format
Input Capacitance Cin = 4 pF (MAX.)
Input Voltage
* Low level = 0 to 0.7 V
* High level = 2.4 V to Vcc + 10%

Data-Line Input Signa
Input Capacitance Cin =
10 pF
Input Voltage
* Low level = -50 mV
* High level = +600 m\

(3) 100B (100 Mbps)



Data-Line Input Signal Format
Input Capacitance Cin = 8 pF (MAX.)
Input Voltage
* Low level = 0 to 0.8 V
* High level = 2.0 V (MIN.)

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5-(9)

Varistors, Surge Absorbers

Varistors Surge Absorbers

The varistor and the surge absorber protect electronic circuits from switching surge a electricity. Please select either SMD type or lead-wire type according to your mounti

1 Chip Varistors (General) 2 Chip Varistors (Automotive) 3 Disk Vari
4 Surge Absorbers 5 Common Specification

1 Chip Varistors (General)

Category	Type	Size(mm)	Varistor Voltage (V)	Max. Allowable Circuit Vol. (V) a.c.r.m.s.	Max. Allowable Circuit Vol. (V) d.c.	Ma Cu (2
SMD	NV73A1E	1005	8 ~ 120	—	5.5 ~ 18	20
	NV73A1J	1608	8.2 ~ 27	4.2 ~ 17	6 ~ 22	
	NV73A2A		8.2 ~ 47	4.2 ~ 30	6 ~ 38	1(
	NV73B2A	2012	8.2 ~ 33	4.2 ~ 20	6 ~ 26	2(
	NV73C2A		8.2 ~ 24	4.2 ~ 14	6 ~ 18	2:
	NV73A2B		27 ~ 56	17 ~ 35	22 ~ 45	
	NV73B2B	3216	8.2 ~ 27	4.2 ~ 17	6 ~ 22	3(
	NV73C2B		8.2 ~ 27	4.2 ~ 17	6 ~ 22	4(

2 Chip Varistors (Automotive)

Category	Type	Size(mm)	Varistor Voltage (V)	Max. Allowable Circuit Vol. (V) a.c.r.m.s.	Max. Allowable Circuit Vol. (V) d.c.	Ma Cur
SMD	NV73D2A	2012	12 ~ 47	6.1 ~ 30	8.6 ~ 34	12(
	NV73D2B	3216	22 ~ 68	14 ~ 45	16~ 56	26(

3 Disk Varistors

Category	Type	Size(mm)	Varistor Voltage (V)	Max. Allowable Circuit Vol. (V) a.c.r.m.s.	Max. Allowable Circuit Vol. (V) d.c.	Ma Cu (2
Disk	NVD05U	$\phi 5$	18 ~ 470	11 ~ 300	14 ~ 385	50
	NVD07U	$\phi 7$	22 ~ 470	14 ~ 300	18 ~ 385	250
	NVD10U	$\phi 10$	22 ~ 1800	14 ~ 1000	18 ~ 1465	500
	NVD10UB		22 ~ 270	14 ~ 175	18 ~ 225	500
	NVD14U	$\phi 14$	22 ~ 1800	14 ~ 1000	18 ~ 1465	100(
	NVD20U	$\phi 20$	200 ~ 910	130 ~ 550	170 ~ 745	700(

4 Surge Absorbers

Category	Type	DC Spark-Over Voltage(V)	Electrostatic Capacitance	Max. Peak Current (A)
Leaded	SA05	200 - 700	1pF max.	500

(1kHz-6V Max.)

5 Common Specification

TOP

Items	PDF
Minimum Ordered Quantity	
Recommended Pad Dimensions	
Packagings For Chip Components	
Axial Tapings	
Radial Taping	
Forming	
Color code•Resistance marking•E series numbers	

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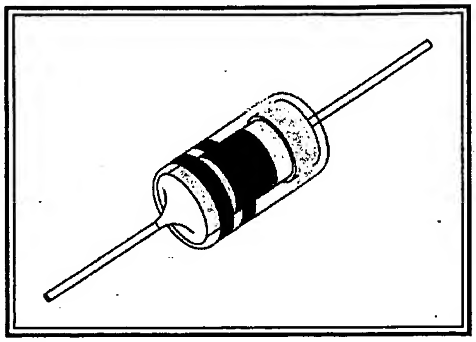
Resistors (SMD) | Resistors (Leaded) | Resistors (Network) | Trimmer Potentiometers | Thermistors Thermal Sensors
Inductors | Noise Suppression Components | Fuses | Varistors Surge Absorbers | Others

MMC ELECTRONICS

MMC Electronics Singapore

Surge Absorbers



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MMC's unique surge protection devices are constructed using laser cut mirco-gap technology. To insure the highest quality devices, MMC assembles them in a Category 2 clean room environment and utilizes an inert gas to fill the glass encapsulant. This gas provides a consistant "atmosphere" for the discharge.

Surge devices are predominantly leaded and have an axial form. Basedd on the application, several options are available. ESD type protection can start as low as 140V arc-over and direct surge protection can go as high as 4500V arc-over. Certain devices are UL/CSA listed and one specific design is uniquely qualified to service the T/R line for UL 1449 protection of communication units.

DIA Surge Series [DA53,DSA,DSP,DSS]

[DA53 Series]

- Small size. (Ø 5.3mm Length 10mm)
- Allows performing the AC with standing voltage test.
- Used to protect power supplies.
- Quick response for surge voltage and low limiting voltage.
- Small Capacitance and excellent insulation resistance.
- Stable for repeated electrostatic test conditions and environmental fluctuation.
- No polarity.
- No dark effect.

Surge Absorber [DSA]

- The Models of this series are extensively used as surge-protecting elements for electronic equipment in low-voltage and low-current circuits such as telecommunication equipment and sensor lines.
- Excellent for protecting signal lines that require low capacitance.
- The DSA-A-type combined with a cement resistor or varistor can be used as surge-protecting elements in power supplies.
- Allows performing the AC withstanding voltage test without

removal of the surge absorber.

Surge Protector [DSP]

- Car radio, radio cassette, wireless, new media.
- Protection from electrostatic discharge in a CRT display or monitor TV. (Except DSP-141N)
- Protection against electrostatic discharge.

Surge Suppressor [DSS]

- Surge protection for telephone lines. (telephone,modem,facsimile etc.)
- Surge protection for telecommuniations lines. (computer etc.)
- Some models are recognized by UL.

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Contact MMC for application notes and copy of our current Surge Protection Device catalog. As with all our prodcuts, samples are available and can be requested thru Customer Service or a designated Representitive in your area.

Information posted for reference only. Please contact us if you have questions or need additional information.

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ダイヤサージプロテクタ〔DSP〕静電気対策用 DIA SURGE PROTECTOR 〔DSP〕 For ESD

サージアブソーバ SURGE ABSORBER

■特長

●カーステレオ、無線機、VTR、BSチューナー等のアンテナの静電気対策に使用できます。
●ディスプレイ装置、モニターテレビ等の管内放電対策（DSP-141Nは、除く）に使用できます。
●その他静電気トラブル防止対策に使用できます。

■Features

●Car radio, radio cassette, wireless, new media.
●Protection from electrostatic discharge in a CRT display or monitor TV. (Except DSP-141N)
●Protection against electrostatic discharge.

■形名構成 Part number system

DSP — 301 N — S 00 B

- DSP: シリーズ名 Series
- 301: 直流放電開始電圧(Vs) DC Spark-over voltage(Vs)

最初の2数字は電圧値の有効数字で第3数字は乗数を表す。
The first two digits are significant, and the third is number of zeros.

例) 301の場合 30×10¹=300v
Ex.) 301 means: 30×10¹=300v

- N: 直流放電開始電圧許容差 DC Spark-over voltage tolerance

M	±20%
N	±30%

- S: テーピング形態 Taping form

A	アキシャル(横型)テーピング Axial taping
C	ラジアル(縦型)テーピング Radial taping
S	ノーテーピング No taping

- 00: テーピング寸法 Taping dimensions (単位:mm Unit:mm)

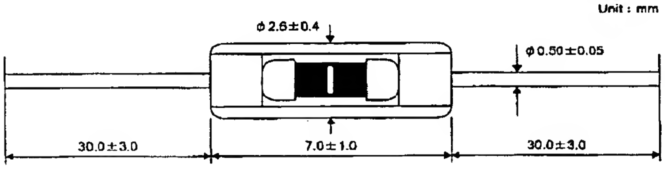
記号 Code	テープ内側幅 Taping width	ピッチ Pitch
04	(ラジアルテーピング) (Radial taping)	12.7
11	26	5
21	52	5
00	ノーテーピング No taping	

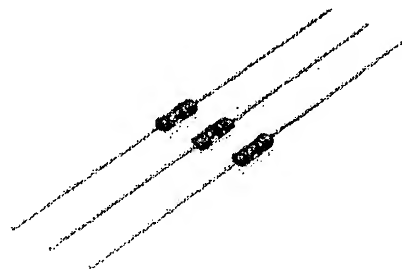
- B: 包装形態 Packing form

B	バラ品袋詰 Bulk pack
F	フラットパック Flat pack taping
R	リール巻 Reel taping

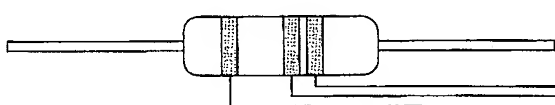
■形状・寸法 Dimensions

単位：mm
Unit：mm





■マーキング Marking



カラーコード Color code		第一色帯 First color band 形名 Part number	第二色帯 Second color band 製造ロット番号の10の桁 The tens digit of product Lot No.	第三色帯 Third color band 製造ロット番号の1の桁 The unit digit of product Lot No.
黒	Black		0	0
茶	Brown		1	1
赤	Red	201M	2	2
だいだい	Orange	301N	3	3
黄	Yellow		4	4
緑	Green	501N	5	5
青	Blue		6	6
紫	Purple	751N	7	7
灰	Gray		8	8
白	White	141N	9	9

■特性 Characteristics

シリーズ名 Series	形名 Part number	直流放電開始電圧 DC spark-over voltage Vs	絶縁抵抗 Insulation resistance IR		静電容量 Electrostatic capacitance 1kHz-6V max. C	サージ寿命 Surge life test
DSP	DSP-141N	140V (98 ~ 182)	100MΩ min.	DC 50V	1pF max.	1500pF-10kV-0Ω 200 times
	DSP-201M	200V (160 ~ 240)		DC 100V		
	DSP-301N	300V (210 ~ 390)				
	DSP-501N	500V (350 ~ 650)		DC 250V		
	DSP-751N	750V (525 ~ 975)				

MITSUBISHI MATERIALS CORPORATION

ダイヤサージプロテクタ〔DSP〕静電気対策用 DIA SURGE PROTECTOR 〔DSP〕For ESD

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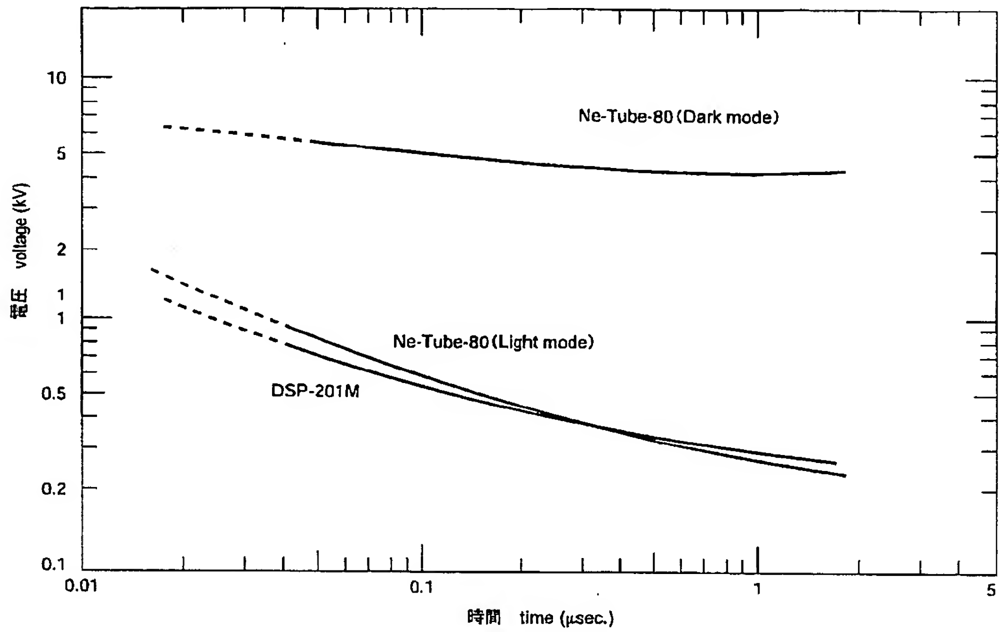
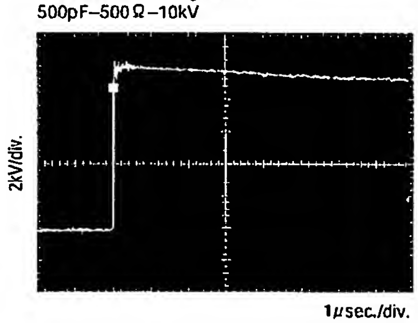
■V–t特性（参考値） V–t Characteristics (Reference)



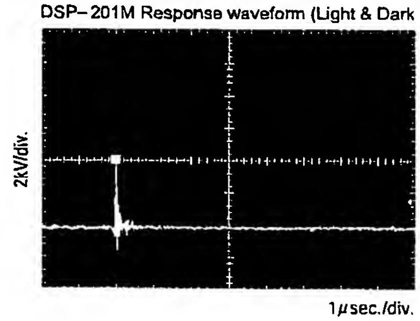
・急峻な立上りの静電気に対して素早い応答特性を示します。
・明暗効果がありません。
· Rapid response against electrostatic discharge with instantaneous rise.
· No dark effect.

■静電気応答特性（参考値） Electrostatic response characteristics (Reference)

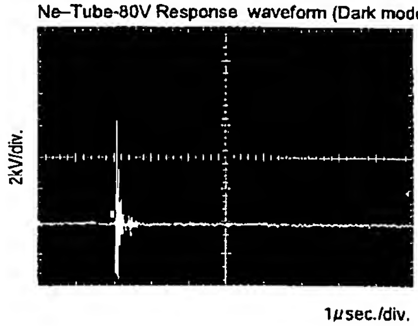
静電気原波形 Original waveform
500pF–500Ω–10kV



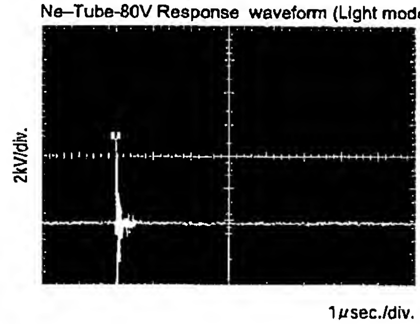
DSP–201M応答波形（明所、暗所）
DSP–201M Response waveform (Light & Dark mode)



Ne管（80V）応答波形（暗所）
Ne–Tube-80V Response waveform (Dark mode)



Ne管（80V）応答波形（明所）
Ne–Tube-80V Response waveform (Light mode)

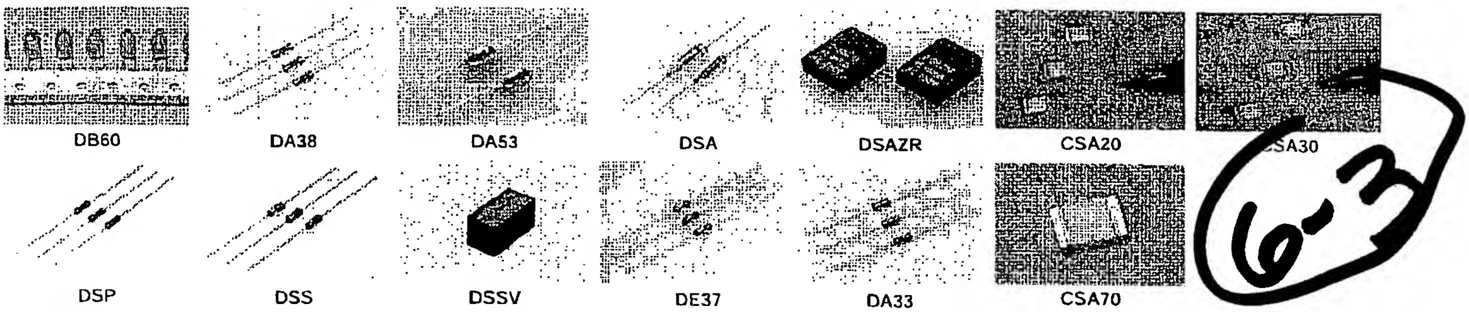


ダイヤサージシリーズ (DB60,DA38,DA53,DSA,DSP,CSA20,CSA30,DSS,DE37,DA33,CSA70)

DIA SURGE SERIES (DB60,DA38,DA53,DSA,DSP,CSA20,CSA30,DSS,DE37,DA33,CSA70)

ダイヤサージシリーズは、マイクロギャップによる電界電子放出機構を応用したサージ吸収素子です。数十μmにカットされたマイクロギャップで放電をトリガし、主放電はキャップ電極間にて行われます。この為、急峻な立上りをもつ、誘導雷、静電気に対してすばやく応答するので、低電圧回路・通信回路・電源回路・エレクトロニクス機器のサージ対策に最適な製品です。

Each DIA SURGE SERIES part has a micro gap cut to an accuracy of several tens of microns in width for rapid response against induced lightning and electrostatic discharges.These components are ideal for protecting low voltage circuits, communication systems and power supply circuits against electrical circuits as well as electronic equipment for surge voltage.

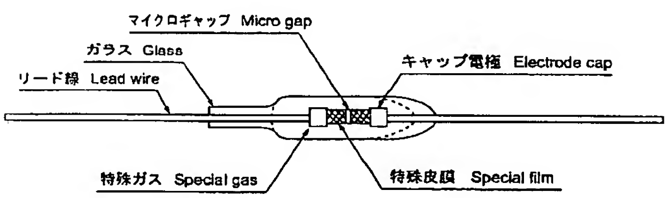


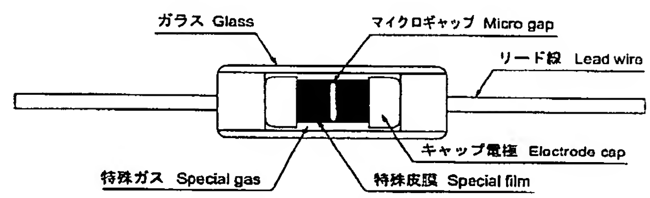
■特長

- ●同一形式で、広範囲の動作電圧（140～7800V）のものが選べます。
- ●サージ吸収特性が良く、制限電圧が低くなります。
- ●静電容量が小さく、絶縁性（100MΩ以上）も優れています。
- ●繰り返しサージ及び環境変化に対して安全です。
- ●極性がありません。
- ●明暗効果がありません。
- ●UL、CSA、TÜV規格認定品もあります。

■Features

- ●Wide voltage range(140~7800V)is available.
- ●Quick response for surge voltage and low limiting voltage.
- ●Low capacitance and very high insulation resistance.(100MΩmin.)
- ●Stable against repeated surges and environmental fluctuation.
- ●No polarity.
- ●No dark effect.
- ●Some models are recognized by UL,CSA and TÜV.





ダイヤサージシリーズの構造 Structure of DSA and DA38,DA53,DSP,DSS,DE37,DA33

■用途 Applications